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U. S. DEPARTMENT OF AGRICULTURE.
OFFICE OF ROAD INQUIRY.
BULLETIN No. 7.

INFORMATION

REGARDING

ROADS AND ROAD-MAKING MATERIALS

IN CERTAIN EASTERN AND SOUTHERN STATES.

(FURNISHED BY OFFICIALS OF THE VARIOUS RAILWAY COMPANIES.)

PUBLISHED BY AUTHORITY OF THE SECRETARY OF AGRICULTURE.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF ROAD INQUIRY,
Washington, D. C., April 16, 1894.

SIR: Communications from officials of various railway companies in some of the Eastern and Southern States have been received by this office. They were written in response to a circular letter of the Department making inquiries regarding road management and road-making. The publication of these letters as Bulletin No. 7 of this office is respectfully recommended.

ROY STONE,
Special Agent and Engineer in Charge.

Hon. J. STERLING MORTON,
Secretary.

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INFORMATION REGARDING ROADS AND ROAD-MAKING MATERIALS IN CERTAIN EASTERN AND SOUTHERN STATES.

The following circular, to which the communications which come after are replies, was issued by this Department in October, 1893:

U. S. DEPARTMENT OF AGRICULTURE,
OFFICE OF THE SECRETARY,
Washington, D. C., October 16, 1893.

SIR: The Department of Agriculture has been authorized by Congress to make inquiry into the systems of road management throughout the United States and the best methods of road-making, and to collect and distribute information regarding the same.

The interest uniformly shown by railway managers in the improvement of highways warrants the Department, which has been charged with this inquiry, in asking their assistance. The undersigned, therefore, respectfully requests: (1) Such information as can doubtless be gained through your engineering department regarding the supply of good road materials along or near your lines—their location, character, accessibility, and the cost of preparation and loading on cars; (2) your schedule rates for transportation of the same; (3) a statement of any reduced rates or free transportation that may have been granted or offered in special cases to encourage road-building; (4) any information, recommendations, or suggestions from yourself or any of your staff that may promote the success of this inquiry or the general interest of road improvements.

Very respectfully, yours,

EDWIN WILLITS,
Acting Secretary.

BRIDGTON AND SACO RIVER RAILROAD COMPANY.

[Furnished by W. F. Perry, president, Bridgton, Me.]

Our railroad is but 16 miles long, we have an abundance of good road material or gravel on the line, and we would make any reasonable concession in hauling it to improve our roads. The actual cost of moving it on the railroad to the point most needed would be about 25 cents per yard.

The management of our roads is simply outrageous. Anything nearest to hand is used. I have been trying to convince our selectmen of the bad results from such management, and that good drainage and a plenty of good gravel would be much better and cheaper in the end.

WEST VIRGINIA CENTRAL AND PITTSBURG RAILWAY COMPANY.

[Furnished by C. L. Bretz, general manager, Cumberland, Md.]

Good road material can be obtained along the line of this road in abundance, at a minimum cost, at numerous points.

At two or three points along the line limestone is found in large quantities, at which points limekilns are being erected and the building of stone crushers con-

templated which will crush stone suitable for highways. This stone could be secured at about 50 cents per cubic yard in cars.

What is most needed in this section of the country is a more efficient management in the distribution of money expended in the way of repairs, and to this end is needed competent engineering skill in that direction. As stated above, good material is abundant for making good roadways, but what is wanted is an intelligent distribution of the same, and when skilled supervision is not available the parties having charge of the work should be furnished with such information, in the way of drawings, etc., as to drainage and placing materials, as would enable them to use it to the best advantage. This railroad is anxious to do all it can to encourage the construction of good public roads and would make a reduction to one-half the regular rates in hauling road material.

NEW YORK AND NEW ENGLAND RAILROAD COMPANY.

[Furnished by L. B. Bidwell, chief engineer, Boston, Mass.]

As to question 1, I would say that on our main line there is the best of blue trap rock about 11 miles west of Hartford, Conn. A crusher is now being arranged for, and crushed stone which will go through a 2-inch ring will be delivered in small lots on cars at 70 cents per ton. Larger lots, of course, will be much cheaper. At the same distance east of Hartford a flinty, light-colored stone, more easily broken, but which will make good roads, is crushed. On our Rhode Island and Massachusetts branch at Diamond Hill, 33 miles from Boston, there is a large quantity of rock which makes a very good roadbed, and has been used to some extent on the highway there. I understand they are crushed and used by the town of Cumberland.

So far as question 2 is concerned, the answer can only be made in a general way, that our schedules are the established fast-freight schedules on mileage basis. It will be impossible to give the exact rates without knowing the points, but the rates vary from $2\frac{1}{2}$ cents to 5 cents per 100 pounds in a distance of 50 to 150 miles.

As regards question 3, no reduced rates or free transportation have been granted or requested to encourage road-building.

DELAWARE, LACKAWANNA AND WESTERN RAILROAD COMPANY.

[Furnished by William Unruh, engineer Morris and Essex division, Hoboken, N. J.]

Trap rock for macadamizing roads can be obtained from Bergen Hill in Jersey City; also at Orange, Milburn, Short Hills, and at West Paterson.

At stations between Dover and Waterloo a hard species of rock resembling granite is to be had.

At Hackettstown a hard blue limestone rock is obtained.

In the vicinity of Morristown an abundance of excellent gravel is to be had at a number of places adjoining the tracks of the Morris and Essex Railroad at a cost of about 40 cents per cubic yard loaded on cars.

With the exception of the trap-rock quarry at West Paterson, which is situated alongside the tracks of the Morris and Essex Railroad, all the quarries are located from three-fourths of a mile to 2 miles from the railroad. In consequence, the prices for broken stone at West Paterson are lower than at the other stations. At West Paterson broken stone, all sizes, can be loaded on cars for 85 cents per cubic yard. The stone will weigh 3,000 pounds per cubic yard.

At Orange the prices for broken stone (trap rock) are as follows: Coarse stone, 2 to 2½ inches in diameter, \$1.40 per ton on cars; coarse stone, 1½ inches in diameter, \$1.50 per ton on cars; fine stone for top dressing, \$1.50 per ton on cars. The stone weighs about 2,700 pounds per cubic yard. At Millburn and Short Hills the price would be about 10 per cent less than at Orange on account of a shorter haul from the quarry to the railroad. At Hackettstown broken blue limestone, very hard, and weighing about 3,200 pounds per cubic yard, can be put on board cars for about \$1 per ton.

In macadamizing the roads at Orange from 16 inches to 2 feet in depth of stone is the usual practice, as the soil is wet and of a clayey nature. At Millburn the roads are stoned to a depth of 4 to 16 inches. Where the soil is of a gravelly nature and the traffic light 4 inches in depth of stone makes an excellent road. The usual width of the roadbed in Millburn township is 16 feet for ordinary country roads and from 25 to 40 feet in width in villages.

Contractors usually get in Millburn township 65 cents per square yard for macadamizing to a depth of 4 inches, 75 cents per square yard for a depth of 6 inches, and \$1.10 per square yard for 12 inches. These prices include rolling and all work necessary, but do not include the grading or formation of the roadbed.

At Mount Arlington the road from the station to the village, a distance of about 3½ miles, was macadamized last summer with stone obtained by crushing the bowlders alongside the road by a portable stone-crusher, which was moved from place to place as the work progressed, thus saving a long haul of the crushed stone. The road was macadamized to a depth of 10 inches for 85 cents per square yard.

This company has aided in the construction of several sections of gravel roads in Morris County. At Denville they built about one-half mile of road for the township of Rockaway a few years ago, and at Port Morris, in Roxbury Township, they have built about 1 mile of gravel road. At other stations some work has been done adjoining the railroad company's property, and at some stations Belgian-block pavement has been laid down by the railroad company in the street adjoining the station.

In regard to questions 2 and 3, relating to transportation, I have no data from which a reply could be made.

The best material for roads is the trap rock, from Orange and Millburn. This rock is very hard, and of a dark and uniform color, and makes an excellent road. The rock at West Paterson is hard, but the color is not so dark as the color of the rock at Orange, and hence it does not make such a handsome road.

A very good road for light traffic is made from the Morris County gravel by mixing about 1 inch of clay on top and then rolling the road.

FALL BROOK RAILWAY COMPANY.

[Furnished by George I. Magee, president, Corning, N. Y.]

(1) In the first place we have no good material for highways along the line of our roads, except along the Pine Creek division, and there are not any highways in that vicinity. Along other portions of our line we use the ashes and cinders dropped by our locomotives.

(2) As we have no material to transport we can not offer any schedule of rates for the same.

(3) We would be glad to offer reduced rates of transportation or free transportation, provided good material were offered for road-making.

(4) I am personally in favor, and so are all of our officials, of better roads, believing that it would conduce to the benefit of railroads generally, but unfortunately we are not situated so that we can assist in the matter of good material.

NEW YORK, ONTARIO AND WESTERN RAILWAY COMPANY.

[Furnished by J. E. Childs, general manager, New York City.]

We have very little gravel or good road material on the line of the road, except between Norwich and Randallville, where there is a fair supply of good gravel. We have gravel of an indifferent quality in the vicinity of Summitville, but it has not been used for highways. Broken limestone of excellent quality can be obtained at Tompkins Cove, on the West Shore Railroad, and we have made in some cases half rates in order to have this used in the streets of villages along our line and for highways. Very little of it has been used, except in incorporated villages or cities. This company has several times subscribed money toward the improvement of highways along the line, in order that we may encourage the transportation over the roads of lumber, flagstone, and hemlock bark for shipment, and also for the better transportation of the milk business to our railway stations.

As a rule, in this State, the roads contiguous to our railway are not well cared for and are in poor condition.

KEESEVILLE, AUSABLE CHASM, AND LAKE CHAMPLAIN RAILROAD COMPANY.

[Furnished by Edmund K. Baber, president, Keeseville, N. Y.]

This company has some light gravel along its road, in somewhat limited supply. I think it would make fairly good roads. We have never transported any road material but might possibly do so, supplying the gravel to connection with the Delaware and Hudson Canal Railroad Company at Port Kent, at \$1 per ton, or thereabouts, to include freight.

ELMIRA, CORTLAND AND NORTHERN RAILROAD COMPANY.

[Furnished by C. W. Williams, general freight and passenger agent, Elmira, N. Y.]

We have an almost inexhaustible supply of the very best gray limestone for road purposes to be found in the State.

Quarries are located at Perryville, N. Y., 8 miles from Canastota, where connections are made with the New York Central and Hudson River Railroad and West Shore Railroad; 18 miles from Sylvan Junction, where connections are made with the New York, Ontario and Western Railroad; 29 miles from Camden, where connections are made with the Rome, Watertown and Ogdensburg Railroad; 8 miles from Cazenovia, where connections are made with the Syracuse, Ontario and New York branch of the West Shore Railroad; 41 miles from Cortland, where connections are made with the Delaware, Lackawanna and Western Railroad; 51 miles from Freeville, where connections are made with the Southern Central division of the Lehigh Valley Railroad; 86 miles from Van Etten, where connections are made with the main line and also Geneva, Ithaca and Sayre division of the Lehigh Valley Railroad, and 111 miles from Elmira, where connections are made with the New York, Lake Erie and Western Railroad, Pennsylvania Railroad, and Delaware, Lackawanna and Western Railroad.

Stone crushed almost any desired size can be obtained f. o. b. cars at Perryville for from 35 to 40 cents per ton of 2,000 pounds, possibly less, and in almost any quantity.

Quite a quantity of this stone was used in the construction of macadamized roads in the city of Elmira during the past summer.

Very low rates for the transportation of this stone can be obtained, not only to points on this line, but also to points on lines named above with which we connect.

LONG ISLAND RAILROAD COMPANY.

[Furnished by H. M. Smith, traffic manager, Long Island City, N. Y.]

We have no stone or other road materials along or near the line of our road suitable for macadamizing or otherwise improving roadways.

During the past two or three years great improvements have been and at present are being made in the roads on the western end of Long Island by macadamizing them; almost all the stone used for the purpose coming from the quarries on the North River. Our charge for transporting this stone, the bulk of which is delivered within a radius of 30 miles, is from 70 cents to 85 cents per gross ton.

NEW YORK CENTRAL AND HUDSON RIVER RAILROAD COMPANY.

[Furnished by Walter Katte, chief engineer, New York City.]

One general roadmaster of this road states that there is no material suitable for road-building accessible to any station on this line east of Syracuse. West of Syracuse there are places where such material can be procured, but at distances of not less than 1 or 2 miles from the railroad.

The general traffic manager of the road states that materials used in making or improving common roads, such as stone, gravel, and timber for bridges and fencing, are classified in the sixth, or lowest-numbered class of our freight classification. The exact rates of freight, expressed in cents per hundred pounds, would, of course, vary with the distance hauled. I do not know of any instance where we have made any reduced rates on such commodities for the purpose of encouraging road-building.

MOUNT JEWETT, KINZUA AND RITERTVILLE RAILROAD COMPANY.

[Furnished by Elisha K. Kane, president, Kussequea, Pa.]

(1) The only road materials along our lines are sandstone and timber. The sandstone is rather soft for road purposes, and as it possesses a value as building-stone and for glass-making it would hardly pay to take it for road-making purposes. Roads in this vicinity are crudely made by the township supervisors who throw the dirt from the side ditches into the middle, cutting poles for corduroy in bad places, and frequently not going to the expense of fully eradicating the stumps. I know of no road in this county outside of the city of Bradford where care enough is taken with the roads to warrant the transportation of material for their construction.

(2 and 3) Never having shipped any road materials except lumber we have had no occasion to make rates on same. Ten dollars per car is the rate established by law for roads of like length in this Commonwealth.

NEW YORK, PHILADELPHIA AND NORFOLK RAILROAD COMPANY.

[Furnished by W. A. Patton, vice-president, Philadelphia, Pa.]

There is no material along the line of our road suitable for road-making. Our line runs through a sandy soil all the way from Delmar, Del., through the Eastern Shore to Cape Charles, Va., a distance of 95 miles. We have no stone or gravel along the line, and this has necessitated the use of oyster shells for ballasting the railroad tracks. We have used oyster-shell ballast to very good advantage for the last four or five years, and the result is that we now have about 80 miles of track covered with shells. So far as I know our road is the only one in the country using oyster shells for ballast. These shells we obtain from the oyster-shucking houses

at Crisfield, Md., and Cape Charles, Va. We have also used the shells to very good advantage on the public roads around our stations, and our policy has been that, where the county authorities desire to improve the roads leading to the stations, we have transported them at reduced rates.

CENTRAL PENNSYLVANIA AND WESTERN RAILROAD COMPANY.

[Furnished by S. B. Haupt, general manager, Watsontown, Pa.]

Our company has at the present time but 31 miles of railroad in operation. The line runs through a rich and thickly settled farming district in Northumberland, Montour, and Columbia counties, Pa.

We have made some inquiry upon the subject of roads and find that nothing of a general character has been done towards the making of good roads along our line. The roads, as a rule, are very good during the summer and fall seasons, but in mid-winter are in some places almost impassable.

We have at a number of places along our line an excellent quality of material suitable for making metal roads, but as the matter has never been taken up by the road authorities we are hardly in a position to answer intelligently all of your inquiries.

(1) We have an almost inexhaustible supply of limestone at Turbotville, Jerseytown, and Millville stations. The stone is quite accessible, and the cost of preparation and loading on cars would be approximately 30 cents per cubic yard. This price is based upon the use of a regular crusher.

(2) Our schedule rates for transportation for this class of materials is 56 cents per ton to the extreme points on our line, this rate subject to reduction, however, for shorter haul. In the event of handling such business we would make a special rate on material for road-making purposes of 40 cents per ton to all points on the line.

(3) We have never been called upon to make special rates for the transportation of road-making materials, but would do so to encourage road building.

(4) We have nothing to offer in the way of suggestions.

THE PENNSYLVANIA RAILROAD COMPANY.

[Furnished by William H. Brown, chief engineer, Philadelphia, Pa.]

I inclose you specification for telford and macadam roads built in Fairmount Park and other places. This work ranges in price, according to the depths, as follows: Twelve inches, \$1.50 per square yard; 9 inches, \$1.15 per square yard; 6 inches, 95 cents per square yard; 4 inches, 75 cents per square yard. This is for trap rock, telford, and macadam work.

If any of the above grade of roads should be built with limestone or any other stone but trap rock it could be done for 25 per cent less money, but the wear would not be in it. These prices are based on a freight rate of 50 cents per ton and cost of cartage.

I might say that where you can haul the stone from the quarry to the road—that is, where the stone can be quarried along the road, and delivered by wagon within a radius of 1 mile to the work—an ordinarily good road, say 9 inches, I think can be built for 80 cents per square yard.

Specifications for telford and macadamized roads (trap rock) in Fairmount Park, Philadelphia.

Telford road, 12 inches in depth.—The roadway is first to be accurately brought to subgrade 12 inches below finished grade, according to the lines and grades given by the engineer, and to conform in cross section with finished surface. Contractor to

make all excavations. Upon the subgrade of the roadway a bottom course or layer of tough and durable stones is to be set by hand, in the form of a close firm pavement. The stones are to be composed of irregular blocks, about 8 inches deep, and 6 to 8 inches wide. They are to be set on their broadest edges, and lengthwise across the drive. All the irregularities of the upper part of said pavement are to be broken off with a hammer, and all the interstices filled in with stone chips firmly wedged with a napping hammer, so as to present an even surface, 8 inches in thickness and 4 inches below finished grade. Upon the pavement as prepared above shall be placed $2\frac{1}{2}$ inches of broken stone, in the manner hereinafter described. The material for this shall be hard, tough, and durable, and must be trap rock, broken so the pieces, in their largest dimensions, shall pass through a ring $1\frac{1}{4}$ inches in diameter. This layer must be thoroughly and completely compacted by a heavy roller. Upon the pavement as prepared shall be placed $1\frac{1}{2}$ inches of broken stone, trap rock, so broken that the pieces in their largest dimensions shall pass through a ring three-fourths of an inch in diameter, and, after being well sprinkled with water, shall be covered with fine trap-rock screenings, which shall be thoroughly rolled into the roadway as a binder. During the rolling of the stone screenings it shall be sprinkled from time to time, keeping it in a moist condition. The quantity of said stone screenings shall be such as will prevent any of the broken stone from appearing above the finished surface after the final rolling. Should any depressions from the rolling or any other cause appear they shall be at once filled to finished grade. The roller used upon this work must not weigh less than 5 tons, and the process of rolling the final dressing shall continue until the finished surface is hard and firm—and will be paid for at so much per square yard of telford road complete. This includes all grading, shaping the sides to conform with the telford pavement where the telford does not extend the entire width of the drive.

Telford road 9 inches in depth.—Is to be constructed as heretofore described for road 12 inches in depth and composed of same materials. The bottom course to be composed of stone 5 inches in depth. The second course to be composed of $1\frac{1}{4}$ -inch stone $2\frac{1}{2}$ inches in depth. The upper course to be covered with $\frac{3}{4}$ -inch stone $1\frac{1}{2}$ inches in depth, covered with screenings, and rolled as heretofore described.

Macadamized road 6 inches in depth.—Is to be constructed under the specifications of the 12 and 9 inch roads as heretofore described, and of the same materials. The bottom course to be composed of stone (trap rock) broken in pieces so that their largest dimensions will pass through a ring 2 inches in diameter. The second course to be composed of $1\frac{1}{4}$ -inch stone $2\frac{1}{2}$ inches in depth. The upper course to be composed of $\frac{3}{4}$ -inch stone $1\frac{1}{2}$ inches in depth, and to be covered with screenings, and rolled as heretofore described.

All the within specified work must be performed in a thoroughly good and workmanlike manner and under the immediate supervision and direction of the chief engineer and superintendent of Fairmount Park, and must be begun within ten days of date of order, and be subject to the final approval of the commissioners of Fairmount Park. And it will be paid for at so much per square yard complete as per proposal.

WEST VIRGINIA AND PITTSBURG RAILROAD COMPANY.

[Furnished by J. A. Fichinger, chief engineer, Weston, W. Va.]

In this State (West Virginia) the public roads are under the management of the county courts or county commissioners, who divide the counties into districts and the districts into precincts, and appoint a road supervisor or, as he is known in this State, a road surveyor, whose duty it is to keep the roads in repair. The county commissioners levy a tax for this purpose, and the statute also gives the road surveyor the authority to require from each male citizen between the ages of 21 and

50 years, not to exceed four days' labor on the road, in addition to the tax mentioned.

The roads throughout this portion of the State are generally in bad condition. There is want of proper care in location in order to secure the best grades and the best ground for the purpose. The roads are also generally very narrow, which confines the travel to single track and does not provide sufficient room for the requisite side drainage. Probably the most important reason of all is the lack of good material from which to make permanent roads. The general character of the soil through this mountainous country is clay and clay loam, which, during the winter months, after becoming saturated, renders the roads nearly impassable.

The only material we have from which to make anything like permanent roadways, is freestone, which we have in abundance, but which is not of sufficient hardness to withstand, satisfactorily, heavy traffic.

I do not see how the railroad company could in any way contribute towards bettering the condition of the public roads by transportation of road material, as there is nothing along its lines in the way of rock that is of any better quality than that to be found along every public road throughout the country, as the stone is all of the same character and there is usually an abundance of it everywhere, of the quality mentioned, so that nothing would be gained by the company making any concession in rates.

In order to make good roads in this portion of the State, it will be necessary to first make such changes in the existing roads as will make good grades without too much expense and then to make all roadbeds not less than 18 feet in width, with proper drainage, and then to macadamize with the best rock that is to be found in each particular locality. The great difficulty in accomplishing this result is to obtain sufficient funds to do this work within any reasonable length of time, on account of the country being so sparsely settled. With the amount of mileage of roads the tax would be exceedingly heavy and more than could be borne by the people at the present time.

WESTERN MARYLAND RAILROAD COMPANY.

[Furnished by J. M. Hood, president and general manager, Baltimore, Md.]

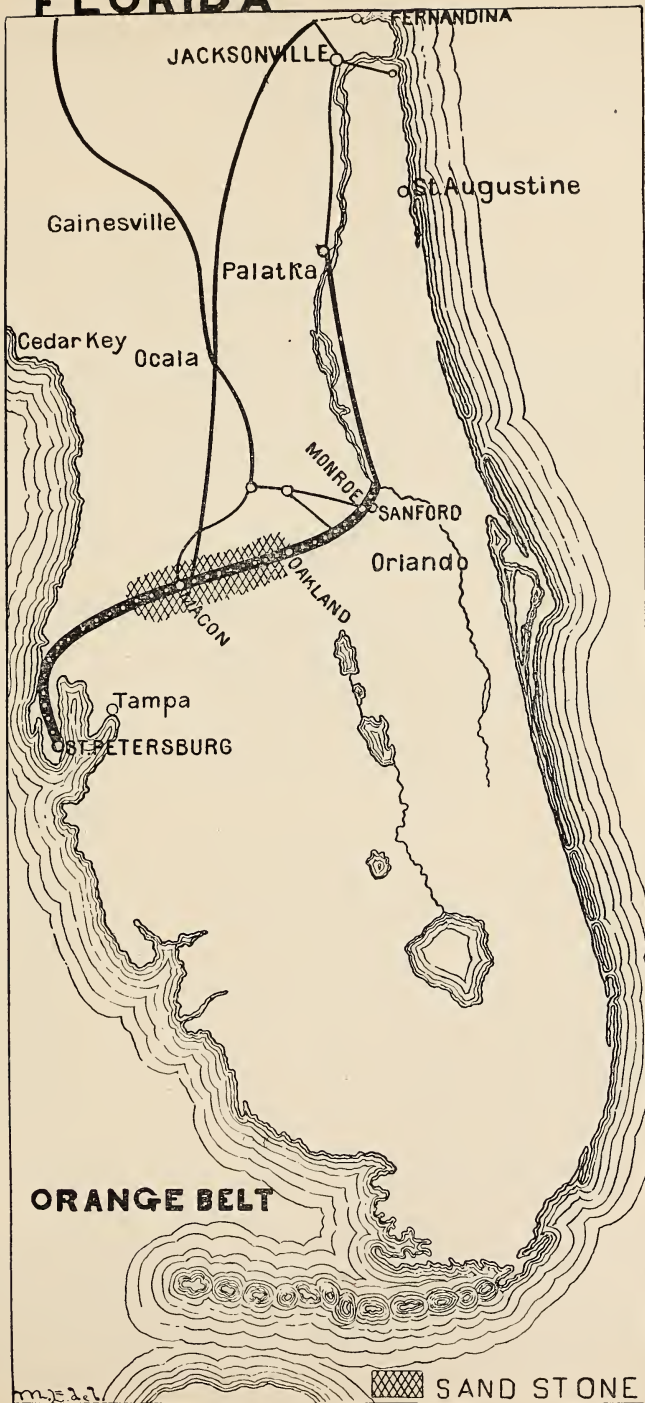
Replying to your circular inquiry as to whether there are good road-covering materials on the lines of this railroad, and whether this company has been or is willing to give special rates for the transportation of same, I would state that our entire territory abounds with limestone or other good stone for macadamizing highways. So far, however, the demand for such material has been largely confined to one of the counties (Baltimore), and to the furnishing of ballast for electric roads upon the public highways. We would be disposed to continue to encourage this business until we find that by so improving the ordinary public roads we are simply preparing beds, at little or no cost, for competitive electric roads, which roads, by our experience, at rates of a cent a mile or less, are simply diverting, or rather destroying, the revenue of this company without apparently making their own operations profitable.

THE PLANT INVESTMENT COMPANY.

[Furnished by H. B. Plant, president, Savannah, Ga.]

In response to your favor, I desire to state that we have found a material on the line of the South Florida Division, Savannah, Florida and Western Railway (one of the roads of the Plant system), that is particularly adapted to the making of good roadways for general traffic. The composition of this material is clay and iron, and the weight is 3,500 to 4,000 pounds per cubic yard.

FLORIDA



The supply is accessible to the line above mentioned, and can be loaded on board the cars at the rate of \$4 per car of 20 tons—40,000 pounds.

We could offer a rate for transporting this material at 1 cent per ton per mile over the lines of the Plant system.

If there is any particular information regarding the material in question that I can furnish you with, I shall be pleased to do so.

ORANGE BELT RAILWAY COMPANY.

[Furnished by William MacLeod, president, Oakland, Fla.]

In reply to circular of inquiry I beg to inclose our schedule of rates on clay and to submit the following information: The Orange Belt Railway, at points near Killarney, Mascotte, Chipco, and San Antonio, cuts through extensive beds of what is locally termed clay or hardpan, but which, geologically, is supposed to be disintegrating sandstone. This material is used at all road crossings of our line, and, having proved to be extremely suitable, it is now in great request by all the towns along its course for use in making streets and sidewalks, which are necessary, owing to the natural soil being a loose, shifting sand. As railway cuts right through these beds they are immediately accessible, and, being of considerable extent, will satisfy needs mentioned above for a long period.

Cost of mining and loading on cars is estimated at from \$4 to \$6 per car, containing 8 to 10 cubic yards. Rates quoted have been slightly shaded on account of interest which railway has in progress and prosperity of settlements in a comparatively undeveloped state; and, for similar reason, no charge has hitherto been made for material as a commercial product in itself.

Schedule rates on clay (carload).

Distance.	Per carload	
	24,000 lbs.	16,000 lbs.
10 miles and under.....	\$5.00	\$4.00
20 miles and over 10	7.00	5.00
30 miles and over 20	8.00	5.50
40 miles and over 30	9.00	6.00
50 miles and over 40	10.00	6.70
60 miles and over 50	11.00	7.35
70 miles and over 60	11.00	7.35
80 miles and over 70	12.00	8.00
90 miles and over 80	13.00	8.70
100 miles and over 90	14.00	9.35
110 miles and over 100	15.00	10.00
120 miles and over 110	16.00	10.70
130 miles and over 120	16.00	10.70
140 miles and over 130	17.00	11.35
150 miles and over 140	17.00	11.35
160 miles and over 150	18.00	12.00

WILMINGTON, NEWBERN AND NORFOLK RAILROAD COMPANY.

[Furnished by H. A. Whiting, general manager, Wilmington, N. C.]

We shall be very glad to coöperate, as far as we can, with the Department of Agriculture in every effort to enlighten our people as to the best methods of road-building, and to encourage them to establish good roads.

(1) In our particular section of country, however, we have very little rock, indeed; and such as we have is shell limestone, in islands, outcropping here and there. In addition to this, there are numerous marl beds, particularly in Jones and Craven

counties, and some in Onslow County; some of which marl might, in the absence of other and better material, serve for road-building. Oyster shells are abundant along our seaboard, and have been used in several instances, where they have been found to make excellent roads, notably at the Government road in Newbern and on Wilmington and Seacoast Turnpike, running from Wilmington about 8 miles down to the sound. Quite a large deposit of shell limestone outcrops on the Trent River about 2 miles below where our road crosses such stream. This, I am informed, could be delivered at \$1.50 to \$2 per ton at Newbern, water carriage down the Trent River.

(2) Our ordinary schedule rates for such material would be those under Class P, of our local freight tariff No. 1, inclosed herewith.

(3) We should be willing, however, in order to encourage as much as possible road-building through our section of country, to give reduced rates of about 50 per cent of those quoted under class P.

(4) The people of our section of country are far from being a prosperous class, and I am afraid it will be long before they will appreciate the importance to them, and the actual saving to them in a pecuniary point of view, to be had from properly constructed roads. Even now, although our road has been in operation some three years, there are not a few farmers who haul their little produce to town over roads deep in sand and in ox or mule carts, rather than ship them by our railroad at the reasonable rates given. It seems to me that the dissemination of pamphlets setting forth in succinct form the advantages, cost, and saving of good roads over bad would be likely to expedite appreciation of their needs on the part of our people as well as of others in other sections of the country. The actual cost per mile of hauling a given load over a poor road, either heavy by reason of mud or of sand, as compared with that of hauling the same load the same distance over properly prepared roads, would go far to awaken interest in the minds of the people whom it most concerns. The more intelligent class of farmers are already beginning, in a general way, to appreciate and acknowledge the desirability of improved roads, and such information in ready form, as above suggested—and I doubt not already under consideration by your Department—would place within the hands of the more intelligent people a powerful argument in their discussions of the matter with their neighbors and friends.

Local freight tariff, No. 1.

Distance.	Per bbl.	Per 100 pounds.		Per ton, 2,000 lbs.		Per carload, 20,000 lbs.		
	F	H	K	L	M	N	O	P
	<i>Cents.</i>	<i>Cents.</i>	<i>Cents.</i>					
5 miles and under.....	10	6	4	\$0.60	\$0.60	\$9.00	\$8.00	\$5.00
10 miles and over 5.....	12	9	5	70	70	11.00	9.00	6.00
15 miles and over 10.....	14	12	6	75	80	12.00	10.00	7.00
20 miles and over 15.....	16	15	7	80	90	13.00	11.00	8.00
25 miles and over 20.....	17	18	7	85	95	14.00	12.00	9.00
30 miles and over 25.....	18	19	8	90	1.00	15.00	13.00	10.00
35 miles and over 30.....	19	20	8	95	1.00	16.00	14.00	11.00
40 miles and over 35.....	20	21	9	1.00	1.10	18.00	15.00	12.00
50 miles and over 40.....	20	21	9	1.00	1.10	18.00	15.00	12.00
60 miles and over 50.....	22	22	10	1.10	1.20	20.00	16.00	14.00
70 miles and over 60.....	22	22	10	1.10	1.20	20.00	16.00	14.00
80 miles and over 70.....	24	22	10	1.10	1.20	22.00	16.00	14.00
90 miles and over 80.....	24	22	10	1.10	1.20	22.00	16.00	14.00

No single package carried for less than 25 cents.

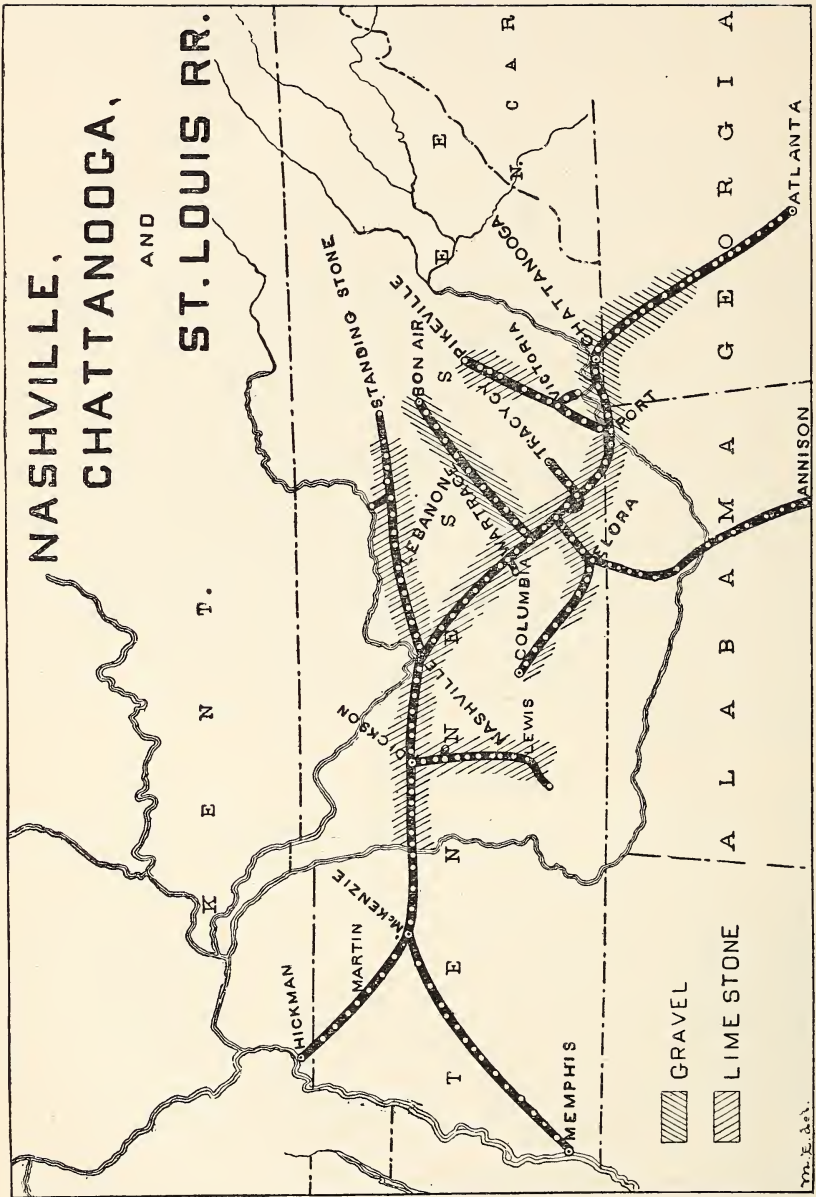
Use Southern Railway and Steamship Association classification, with exception sheet of the associated railways of Virginia and the Carolinas.

Carload quantities rated at 20,000 pounds, except lumber.

Lumber and all articles embraced in lumber rated at 24,000 pounds.

A carload of any article enumerated in Class P, except lumber and articles included in lumber, is 25,000 pounds.

For points on New River add 5 cents per hundred pounds to the Jacksonville rate.



SOUTH BOUND RAILROAD COMPANY.

[Furnished by J. E. Tucker, vice-president and treasurer, Savannah, Ga.]

Some weeks ago I received a circular asking for information as to the improvements of highways and the best methods of road-making. With an apology for the delay in answering your inquiries, I would state that I have, through the engineering department, endeavored to inform myself upon the subject, with the following result:

Good roads can be made generally in the country tributary to the South Bound Railroad (Columbia, S. C., to Savannah, Ga., 142 miles) by proper drainage and by giving the roadbed the proper form without using other material than that found alongside of the roads as they now exist, and in a few exceptional cases where material is not immediately available it can be found not far removed and where the cost of transportation would be very slight.

The prevailing material along the route of the South Bound Road is sandy loam, which, with proper drainage, makes a good roadbed for the use of wagons.

The material called "chert" is not found adjacent to the line of the railroad.

The course of the South Bound Railroad lies below the sand hills of the Augusta region and within what might be called the area of alluvium deposits, although it is overlaid by occasional sand ridges brought down and formed by the streams. On our construction trains this sandy loam was hauled by us and used for filling in low places in the roadway and ballasting, at a cost of about 12 cents per cubic yard in the track, which includes the cost of loading, unloading, and transporting.

NASHVILLE, CHATTANOOGA AND ST. LOUIS RAILWAY COMPANY.

[Furnished by Hunter McDonald, chief engineer, Nashville, Tenn.]

The best road material found on our line of road is crushed limestone. Limestone is found at almost every point on our line, except that from the Tennessee River westward to the Mississippi, and from Resaca, Ga., to Atlanta, Ga. The stone can be quarried and crushed and put on the cars for about 80 cents per cubic yard.

The limestone in the Tennessee basin between Kingston Springs and Murfreesboro is of very poor quality, being soft and friable. All of the limestone south of Murfreesboro is of a hard, compact character, suitable for macadam, and is accessible at almost any point. Our rates on this class of material would be about 1 cent per ton per mile, depending on the distance hauled. I know of no special rates having been offered on any occasion, for the reason that systematic road building is seldom indulged in in this section of the country except by turnpike companies, and where this is done the material immediately at hand is all that is used. Between Kingston Springs and the Tennessee River there is an excellent flinty gravel, which is abundant in all the creek beds and is extensively used. Between the Tennessee River and the Mississippi the roads are mostly sand, and where they are inclined to be boggy they are cross-laid with plank or poles. I regret to say that I have no suggestions to make with regard to any methods of improving the condition of our roads, for the reason that until our laws in this respect are altered and the money expended in a more intelligent way than it is now I do not look for any improvement; neither do I anticipate any favorable change in the laws in the near future.



NORFOLK AND WESTERN RAILROAD COMPANY.

[Furnished by Charles S. Churchill, engineer maintenance of way, Roanoke, Va.]

In answer to your first question I beg to state that good material for macadamizing roads is to be obtained at very numerous points between Lynchburg on the east and Bristol on west; points for obtaining good road material are just as frequent on our Maryland and Washington division between Roanoke and Hagerstown, Md., on our Winston-Salem division between Roanoke and Winston-Salem, N. C., and along the New River line and the Ohio extension from Radford on the east to the Ohio River on the west. Our Scioto Valley division, in Ohio, from the Ohio River at Kenova to Columbus, is supplied with a sandstone near the Ohio River; good gravel beds are to be found at various points in the valley of Scioto River, and good roads can be made from this material; limestone may be obtained in the vicinity of Columbus; it costs, f. o. b. cars at Columbus, 60 cents per cubic yard, broken to proper size for macadamizing. The Clinch Valley division from Bluefield to Norton is extremely well supplied with excellent limestone for road-making and our North Carolina division from Pulaski, to Ivanhoe, and up into the iron mines is equally well supplied.

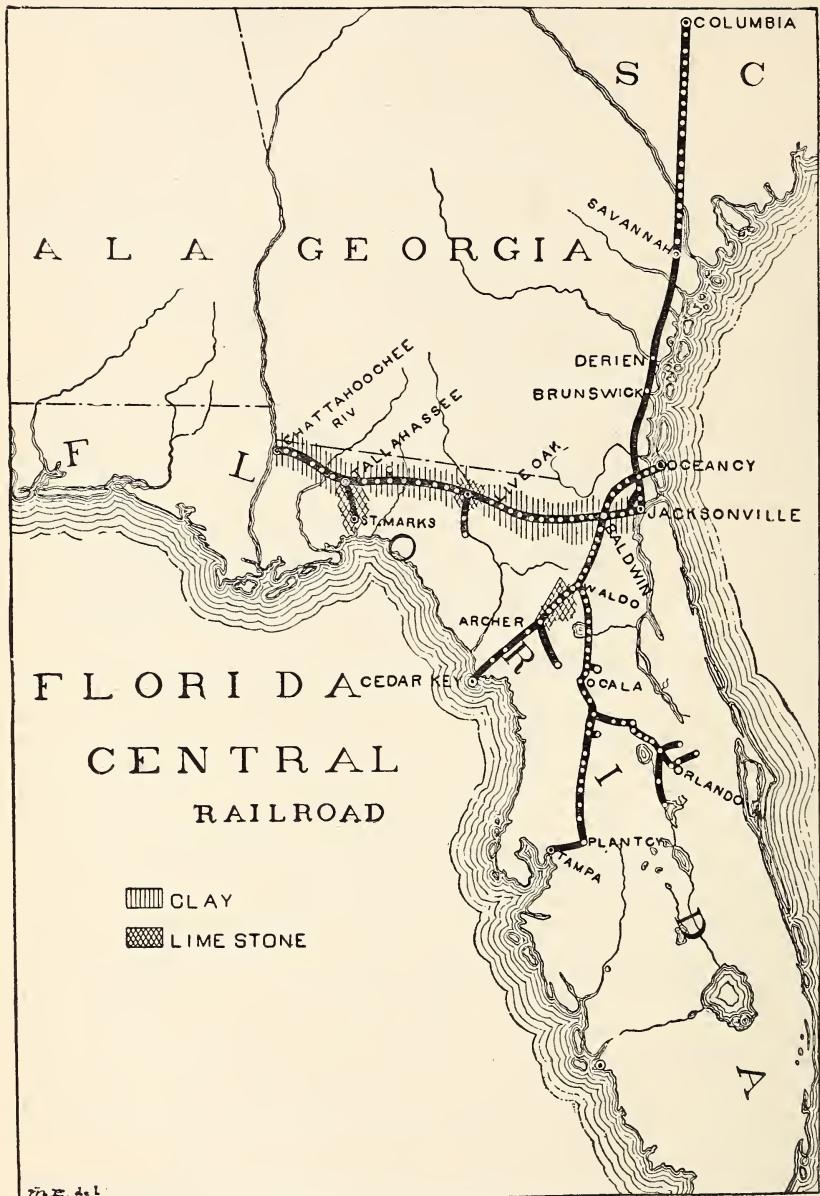
The material found between Lynchburg and the summit of the Blue Ridge Mountains is a hard sandstone. Between the Blue Ridge Mountains on the main line and Pulaski it is limestone. Between Pulaski and Bristol it is either hard sandstone or limestone. On the Maryland and Washington division the material is either limestone or hard sandstone, and the same statement may be made as regards the material along the New River line and the Ohio extension. The Durham division, extending from Lynchburg to Durham, N. C., is not so well supplied, but a good sandstone may be found on the northern end of the line. That portion of our main line from Norfolk to Lynchburg is not so well supplied with stone. The soil is either sandy or is composed of light loam, and wherever stone is found it is mostly granite, which is too expensive for ordinary roadmaking. However, sand and gravel may be found in sufficient quantities to make a good roadway providing the material at hand is properly handled, and I think there is no reason in the world why excellent roads can not be constructed from the materials at hand between Lynchburg and Norfolk. At all points along our system west of Lynchburg excellent macadamized roads may be constructed at very reasonable cost from quarries along the road being improved, or else from quarries along the line of our railroad, requiring only short hauls. All parts of our railroad west of Lynchburg is ballasted with either limestone or sandstone, obtained at various points along the line where we operate ballast-crushers, and the cost to us of this ballast, ready for track, ranges from 40 to 60 cents per cubic yard, f. o. b. cars.

(1) Our schedule rates for road materials are shown on the inclosed statement.

(3) Our company has never been called upon to give reduced rates for material for county road improvements. I think, however, that in case large orders were placed for any such materials, some reduction could be secured from the schedule rates.

(4) The subject in general is a very interesting one, especially in the State of Virginia, where very little improvement has been made in roads during the recent years. Several turnpikes exist in the State to-day, showing excellent workmanship in years past, but nothing is being done worth mentioning now, excepting the making of ordinary repairs. For this purpose the "chain gang" is often used.

As president of the Association of Engineers of Virginia, I am very glad to be able to state that this is a subject which this association has been discussing very freely for the last year. At our summer meeting, held in June, a committee of five was appointed to frame, for the approval of the association, a suitable bill for the reforming of present road laws, this bill to be handed to our representative, to be presented before the State legislature. That committee will be prepared to report at our annual meeting in January.



The Association of Engineers of Virginia recognizes the fact that Virginia is very far behind in its present road laws and methods of improving county roads, and we hope to secure improvement in the construction of county roads at an early date. Certainly any action of the Department of Agriculture will be of very great benefit to the State of Virginia, and I trust that the information which the Department may secure will be furnished to the members of the Virginia legislature.

Freight rates for the distances given on stone, general building material, paving material, etc., in carload lots.

Distances.	Cents per 100 pounds.
1 mile to 5 miles, inclusive.....	2
6 miles to 10 miles, inclusive.....	2½
11 miles to 30 miles, inclusive.....	3
31 miles to 50 miles, inclusive.....	3½
51 miles to 60 miles, inclusive.....	4
61 miles to 90 miles, inclusive.....	5
91 miles to 120 miles, inclusive.....	6
121 miles to 150 miles, inclusive.....	7
151 miles to 180 miles, inclusive.....	8
181 miles to 200 miles, inclusive.....	9
201 miles to 270 miles, inclusive.....	10
271 miles to 310 miles, inclusive.....	11
311 miles to 340 miles, inclusive.....	12
341 miles to 370 miles, inclusive.....	13
371 miles to 410 miles, inclusive.....	14
411 miles to 430 miles, inclusive.....	15
431 miles to 450 miles, inclusive.....	16
451 miles to 470 miles, inclusive.....	17
471 miles and over.....	18

Minimum carloads, 24,000 pounds

JACKSONVILLE, ST. AUGUSTINE AND INDIAN RIVER RAILWAY.

[Furnished by J. R. Parrott, vice-president, Jacksonville, Fla.]

We have always given one-half our regular rates to encourage good road building. The material along the line of road is not in varied quantity, although we have coquina rock, oyster shells, etc., in considerable quantity at different points, and these make excellent roads.

If I can answer your questions any more fully, I shall be glad if you will write me further.

FLORIDA CENTRAL AND PENINSULAR RAILROAD COMPANY.

[Furnished by Blair Burwell, jr., chief engineer, Jacksonville, Fla.]

Your letter of October 16, asking information relative to material for building roads in Florida, has been referred to me for reply.

(1) To take up your first question: "The supply of good road materials along or near your road, their location, character, accessibility, and the cost of preparation and loading on cars," there is along the line of our road at various points large quantities of lime rock (I might say an inexhaustible supply), which can be found at the following points:

Between Tallahassee and St. Marks; near Ellaville, on the Suwannee River, Suwannee County, and south of Gainesville, on the Cedar Key and Archer divisions of our road. This stone could be loaded on cars with ease and large quantities are now being shipped to the coast for use by the U. S. Government in their jetty work, the character of the rock being deemed by the Government engineers sufficiently hard for that purpose. It costs now about 70 cents per ton, f. o. b. our cars. As to cost of preparation would say that it is in shape when it is loaded on cars for the first

layer for either macadam or Telford road; for the second layer or crushed rock I can not give definite cost, but should say that if it is to be used in sufficiently large quantities to warrant putting up a properly arranged plant it could be crushed and put on cars for 40 cents additional to price given above.

There is also near Gainesville a rock that is to all appearance common lime rock, of which I have never seen an analysis, but which seems to possess some of the properties of cement.

This material is softer than lime rock and is called here "soft rock," from the fact that it is soft when taken from the ground, but it hardens when exposed to the air and becomes solidified when used in roads. The town of Gainesville, Fla., has used this for several miles of streets, with good success. The rock was laid in the usual way, with large pieces in the first layer and small ones in the second, with no top layer of clay or earth put on. The weight and abrasion of wheels soon crushed some of the smaller pieces, which seemed to unite and form a smooth surface. This material seems to wear well and the citizens are much pleased with it. It is found in large quantities near Gainesville, Micanopy, and Evanston, and can be loaded in cars for 75 cents per ton. Near Hawthorne, in Alachua County, there is a sandy clay that has been applied to the Hawthorne streets, with very good results. The trouble with the roads in all the southern parts of the State is that they are sand and, except in wet weather, are very dusty and wheels sink to such depth that only very small loads can be hauled, and the clay forming a hard surface over the sand prevents the wheels from sinking, while the sand underneath effectually drains the roadway.

All the streets in Orlando, Fla., are paved with a pale-red clay, which they get from points in the neighborhood, and which makes very good roads. The cost of this clay f. o. b. cars is about 15 cents per cubic yard, and this price can be taken as about the cost of clay f. o. b., at any of the points where it can be obtained, exclusive of the price paid for the land from which it is taken.

Our railroad runs through almost every variety of soil found in the State, but considering it in its relation to roads it is only necessary to divide it into two classes, viz, clay and sand.

The first named is in what is known as Middle Florida, commencing on our road, as you go west from Jacksonville, at Madison, and extending to a point about 50 miles west of the Chattahoochee River; the balance of the State can be classed as sandy.

My own idea of the proper roads for Florida is that those in Middle Florida, where the soil is clay, should be macadam, well drained, and those in south Florida could very well be made of clay, about 12 or 18 inches deep in center and well rounded to sides to shed the water, and the sand on which the road is built will keep it well drained.

As to schedule of regular rates or reduction of same I can say but little, but I have no doubt that in this matter our road would pursue their usual liberal course and make the rates perfectly satisfactory.

BIRMINGHAM AND ATLANTIC RAILROAD COMPANY.

[From G. A. Mattison, superintendent, Talladega, Ala.]

In compliance with your request in circular letter of October 16 last relative to the systems of road-building, I beg to submit for your information the following:

(1) There exists along and adjacent to the line of this road in Talladega County and near the Coosa River inexhaustible quantities of lime rock and gravel. The first named can be quarried, crushed ready for use, and loaded on cars at a cost of

\$1.25 per cubic yard. The gravel consists of pebbles, ranging in size from $\frac{1}{4}$ to 4 inches in diameter, and lie in the same territory as the lime rock, and can be loaded on cars at a cost of about 60 cents per cubic yard.

While this gravel makes a good road ballast when properly applied, I regard the crushed lime rock much superior to it.

(2) Our minimum freight rate is 25 cents per gross ton on this class of freight, and we can deliver it to either of the three roads named below:

Louisville and Nashville at Talladega; East Tennessee, Virginia and Georgia at Barclays; Georgia Pacific at Pell City, Ala. The existing freight rate on this class of business is about half a cent per ton per mile when hauled a longer distance.

We shall be pleased to offer special inducements in the way of freight rates, etc., looking to the betterment of our public roads, if called upon to do so.

BENNINGTON AND RUTLAND RAILWAY COMPANY.

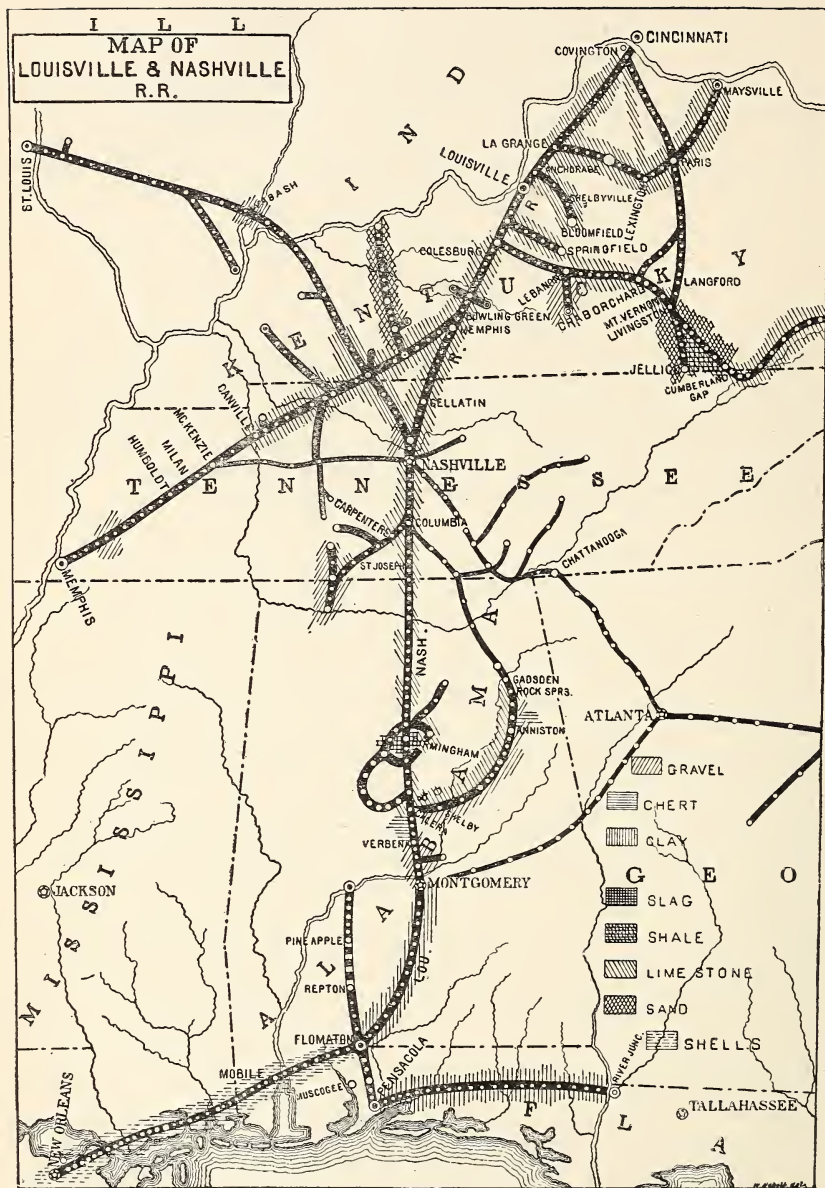
[Furnished by H. W. Spafford, general freight agent, Rutland, Vt.]

Our president, J. G. McCullough, expresses his live interest in the subject of good roads. He directs that this road make half rates on material for purposes of improving the condition of our road systems, whenever such a movement becomes general. Along our line the material for road-building is good and can be placed on cars at a reasonable cost. This company is in hearty sympathy with the movement and when the time comes will endeavor to do its share in the good work.

LOUISVILLE AND NASHVILLE RAILROAD COMPANY.

[Furnished by Stuart R. Knott, first vice-president, Louisville, Ky.]

Referring to your circular letter dated Washington, October 16, 1893, I beg to hand you herewith a condensed tabulated statement, prepared by our chief engineer, showing the location, character of material, extent of supply, approximate cost per cubic yard placed on board cars of road-making material in territory adjacent to the Louisville and Nashville Railroad, together with a map of the Louisville and Nashville Railroad Company's lines, from which can be learned the different locations referred to in the tabular statement. We should be glad to furnish a schedule of the rates that would be applied upon material of this nature between any designated points. The company has made rates less than its established tariff rates for the transportation of material to be used in the construction of roads to encourage road-building. It would be impracticable without great labor to cull from the company's voluminous records even an approximate statement of the cases where rates of freight transportation may have been made in the past on this account. It will be observed from the tabular statement herewith inclosed that in many cases paving material for construction of roads in territory adjacent to this company's lines is stated as underlying a large territory, and is therefore accessible to the local authorities in the territory through which roads are constructed or improved, not dependent upon transportation of the material by rail. We appreciate the importance of the subject now receiving your consideration and shall be glad to be advised of any further action you may take and to furnish you with any additional information we have or may be able to secure.



Paving material in territory adjacent to the Louisville and Nashville Railroad.

Division of railroad.	Location.	Character of material.	Extent.	Points at which facilities exist for loading large quantities.	Approximate cost per cubic yard on cars.
Kentucky Central, main line	Between Covington and Lexington.	Limestone	Unlimited supply underlying large territory.	.....	Cents. 60
Do	Between Langford and Sinks.	Freestone.	do	.....	60
Paris and Maysville branch	Between Paris and Maysville.	Limestone	do	.....	60
Paris and Lexington branch	Between Paris and Lexington.	do	do	.....	60
Cincinnati division	Between Independence and LaGrange.	do	do	Worthville	60
Lexington branch	Between LaGrange and Lexington.	do	do	Benson	60
Shelby R. R.	Between Anchorage and Shelbyville.	do	do	Anchorage	60
Cumberland and Ohio, northern division.	Between Shelbyville and Bloomfield.	do	do	.....	60
Louisville, Harrod's Creek and Westport R. R.	Between Waterworks and Glenview.	do	do	Near Calahans.	60
Main stem, first division	Between Colesburg and Bowling Green.	do	do	Near Tunnel Hill.	60
Knoxville division.	Between Lebanon Junction and Crab Orchard.	do	Unlimited, but generally deep under ground.	Near Glasgow Junction	60
Do	Between Mt. Vernon and Livingston.	do	Unlimited and close to surface.	.....	60
Do	Between Livingston to Jellico.	Sandstone and shale.	Unlimited but irregularly distributed; much of the sandstone soft and friable.	Marathon.	60
Cumberland and Ohio Southern division.	At Sparlington and near Greensburg.	Limestone	Unlimited.	.....	60
Do	Between Calvary and Spurlington.	Gravel.	Limited supply in river and creek beds.	.....	35
Bardstown and Springfield branches.	At various points along line.	Limestone	Unlimited supply underlying large territory.	Clermont	60
Main stem second division.	Bowling Green to Nashville	do	do	Rockland	60 to 75
Nashville and Decatur division.	Between Nashville and State line.	do	do	Carters Creek	60
Nashville, Florence, and Sheffield Rwy.	Between Columbia and Carpenters.	do	Unlimited supply at various points	.....	.....
Do	Between St. Joseph and Jacksonburg.	do	do	Iron City	50
Do	At various points.	Gravel.	Large supply within short distance from railroad.	.....	50
West Point branch	In creek beds.	Limestone	Unlimited supply accessible.	.....	50
Do	At Lacon, Wilhites, Bangor, Blount Springs, Siluria, Calera.	Gravel.	Large supply within short distance from railroad.	.....	50
South and North Alabama R. R.	At Jemison	Limestone	Unlimited quantity close to surface.	Bangor, Blount Springs, Siluria and Calera.	45
Do	At Birmingham and vicinity.	Chert.	Small deposit accessible.	.....	30
Do	.....	Blast furnace slag	A large amount available when furnaces are in operation.	Birmingham and Oxmoor.	20

Paving material in territory adjacent to the Louisville and Nashville Railroad.—Continued.

Division of railroad.	Location.	Character of material.	Extent.	Points at which facilities exist for loading large quantities.	Approximate cost per cubic yard on cars.
South and North Alabama R. R.	Between Verbena and Alabama River.	Gravel.	Limited amount now accessible.	Deatsville.	25
Birmingham Mineral R. R.	Gate City, Launa, and near Spaulding Junction.	Limestone	Unlimited quantities close to surface.	Gate City and Launa.	45
Do.	Southeast slope of Red Mountain.	Chert.	In great abundance and easily loaded.	Various points.	30
Montgomery and Mobile division.	Montgomery to Mobile.	Sand and clay.	No rock material available.	.....	.....
New Orleans and Mobile division.	Mobile to New Orleans.	Shells.	.....	.....	20
Pensacola division and Pensacola and Atlantic division.	Pensacola to Chattahoochee.	Sand and clay.	.....	.....	.....
Alabama Mineral R. R.	Gadsden to Anniston.	Chert.	Large quantities accessible.	.....	60
Do.	Christopher, Rock Spring, Wewoka, and Hawley.	Limestone.	Unlimited supply accessible.	.....	75
Do.	At various points.	Gravel.	Limited supply.	.....	60
Memphis line.	Between Bowling Green and Danville.	Limestone.	Unlimited, but much of it deep under ground.	.....	60
Do.	At McKinnon and Brunswick.	Gravel.	Limited amount available.	.....	25
Clarksville and Princeton division.	Between Needmore and Kennedy.	Limestone.	Unlimited supply.	.....	50
Clarksville, mineral branch.	Between Hematite and Eisen.	.....	.....	.....	50
Owensboro and Nashville Rwy.	At Russellville and South.	.....	.....	.....	50
Do.	Between Russellville and Owensboro.	Sandstone.	Unlimited supply of soft sandstone at various points.	.....	50
Cumberland Valley division.	Between Corbin and Middlesboro.	Sandstone and shale.	Unlimited supply at various points.	Shawaneet, Wheelers, and Pennington.	50
Do.	Between Middlesboro and Norton.	Limestone.	.....	Hopkinsville.	50
Henderson division.	Between Kelleys Station and Edgefield Junction.	.....	.....	.....	50
Do.	At Goodletts.	Gravel.	Limited amount available.	.....	25
St. Louis division.	At Wabash River.	.....	Limited quantity of gravel of inferior quality.	.....	18

BALTIMORE AND OHIO RAILROAD COMPANY.

[Furnished by Thos. M. King, second vice-president.]

(1) Supply of good road material along line of the Baltimore and Ohio Railroad—location, character, accessibility, and cost of preparation and loading on cars.

Philadelphia Division.—There is a good quality of stone along almost the entire division, especially in the vicinity of Havre de Grace. At the Baltimore end of the line, broken oyster shells are extensively used for roads. The cost of preparation and loading of stone on cars ranges from 70 cents to 85 cents per cubic yard.

Main line between Baltimore and Cumberland.—Blue limestone of exceeding hardness and in great quantities exists along the entire line. This stone is of the same quality as used on the national pike between Frederick and Cumberland, and makes macadamized roads of good wearing capacity.

Between Cumberland and Wheeling.—There are several varieties of stone along the line, viz, limestone, bluestone, and sandstone, all of hard texture. The limestone and bluestone make good roads, particularly the bluestone found in great quantities along the third division. This stone is being extensively crushed by the Standard Lime and Stone Company for ballast.

Pittsburg Division.—The stones on this division are principally sandstone and of fine quality for bridge work and buildings. They are not, however, a good stone for roads, as when broken in small cubes, they are apt to grind up too fine for a good road and seem to disintegrate. A fine quality of bluestone is found along this division which is broken into cubes or blocks which are used in the streets of Pittsburg and other cities for paving. When used as paving, they show a long wearing quality. It is possible if this stone was broken fine it would make a fine macadamized road. Limestone exists in great quantities, but is located back from the railroad. It makes fair roads when broken into cubes of 2 inches and if laid on a foundation of larger stone.

Lines west of Ohio River.—Near the river stone is found, but along the entire line the material principally used is sand and gravel, which, if banked high in the middle, so as to shed the water, make fine roads. The gravel found along the line is used almost entirely for ballasting the railroads.

The items of cost per cubic yard to quarry, crush, load, and unload from cars of 22 cubic yards capacity are about as follows, the cost varying in different localities: To quarry, 40 to 50 cts.; to crush, 10 to 15 cts.; to load, 20 to 25 cts.; to unload, 15 to 20 cts. Thus, the cost to quarry, crush, load, and unload is about 85 cents to \$1.10 per cubic yard. The cost depends upon the plant used and superintendence of the work.

(2) The rates for such material are classified as class D, and are as follows:

9 miles.....	30 cts. per ton.
9 to 13 miles	43 cts. per ton.
13 to 20 miles	56 cts. per ton.
20 to 30 miles	70 cts. per ton.
30 to 40 miles	82 cts. per ton.
40 to 50 miles	94 cts. per ton.
50 to 60 miles	\$1.06 per ton.
60 to 70 miles	1.20 per ton.

(3) There have been reduced rates, that is, half rates allowed to parties living along the line of the Philadelphia division on road materials, principally broken oyster shells shipped from Canton. The effect of such rates seems to be that the majority of the county roads leading to stations on the Philadelphia branch are now in fine condition. This, applies to the road between Baltimore and Havre de Grace; beyond that towards Philadelphia, the roads are also in fine condition and have been made of finely-broken stone. The rates alluded to as half-rates were only allowed by the

freight department in special cases upon the recommendation from officials of the railroad company. Whilst the majority of the roads along the line of the railroad are fairly well constructed, the principal cause of bad roads is imperfect drainage, which causes the water to flow over the road and keep it constantly wet.

FLORIDA SOUTHERN RAILROAD COMPANY.

[Furnished by C. R. Knight, chief engineer, Jacksonville, Fla.]

Few attempts have been made to improve the highways of Florida, outside of the large towns. The most important was the construction of the King's road, from Savannah to St. Augustine, during colonial times, which, more than a century later, is an excellent roadway. Several other roads of greater or less length were built during British or Spanish occupation, but very little has been done in late years. The State has no organized bureau of public improvement. The counties have a road fund, but it is chiefly expended in repairing places which would otherwise be impassable, and little of a permanent nature is attempted. In some counties the convicts are worked on the roads. The progress on such work is slow, but it does in some instances result in well located and graded roads. With this labor Duval County has nearly completed a good road from Jacksonville to the ocean, through swamps which were almost impenetrable, and which could only be safely passed with an experienced guide. Through these swamps an excellent and durable corduroy can be cheaply constructed of the cypress poles which are always abundant in such localities.

Almost the entire surface of Florida is sand, mixed with vegetable matter in varying quantities. So far as roads and road-making are concerned there are two very distinct conditions. The low and nearly level sections, popularly termed "flat woods," have exceptionally fine roads without the trouble of making them, except grubbing a few of the larger roots. The surface is firm and the soil to a considerable depth is filled with the fibrous roots of various shrubs, which are very tenacious of life and are rarely cut through even by years of travel. On the contrary the high grounds are destitute of undergrowth, and wheels make deep cuts in the yielding sand. Dust and shavings from saw and planing mills, the refuse from fiber factories, and the pine leaves which fall during the autumn are frequently used to improve them, and with excellent effect, though the benefit is only temporary.

We have at many points throughout the State deposits of good materials for road making. Clay is perhaps most widely distributed. While it rarely crops out on the surface it is found in most sections at no great depth. It is red or yellow, contains a considerable percentage of sand, and when exposed to the sun and rains soon presents a smooth, unyielding surface. We are using it for road crossings on some of our lines with gratifying results, and some towns, notably Orlando and Tampa, have fine streets made from this material. Throughout the central portion of the peninsula are abundant deposits of limestone. There were considerable quantities on the surface, but where these were convenient to transportation they are mostly consumed, not so much, however, in road making as in foundations and river and harbor improvements. There is still beneath the surface a practically inexhaustible supply, which can be cheaply procured. When first quarried this stone is soft and easily reduced to a good surface. It hardens rapidly on exposure and makes a durable pavement for light traffic. Its worse features are that the white glare under the sun is trying to the eyes, and without frequent sprinkling the dust is objectionable. Its use has resulted in fine streets in Gainesville, Ocala, Palatka, and other towns. There are large mounds of snail and oyster shells on the coasts, and even at some points well in the interior, and some conglomerate deposits of clam, conch, and other shells mixed with marl or clay. The snail shells are light,

easily pulverized, and of little value, but the oyster shells are valuable, and the mixed shells perhaps best of all. They contain enough lime to thoroughly cement the shells and soon become equal to well made concrete. Most of the old roads above mentioned received a top dressing of oyster shells, and they have recently been extensively used in Titusville and other towns. The coquina rock, which is so abundant along the east coast, is worthless in its natural state. It pulverizes, will not cement or pack, and is no improvement over the sand. It is unexcelled as a material for making concrete, and to this fact St. Augustine owes its miles of fine pavements.

The cost of these materials of course varies greatly with the conditions. If these are favorable, clay, shell, or limestone can be loaded on cars for 50 cents per cubic yard. As to the cost of transportation, there is no use of mentioning our schedule rates, as we have invariably performed this service at a nominal price, never exceeding one cent per ton per mile, and usually less. A large contract for limestone pavement has been recently completed in Palatka. We hauled this stone about 50 miles, and after the streets were graded and curbed, the stone was evenly distributed, 12 inches deep, thoroughly packed, and reduced to a smooth surface, the total cost was 30 cents per square yard.

Permit me, in conclusion, to express the opinion, based on the experience and observation of ten years, that the population of Florida is still so small, many of the rural inhabitants so conservative and others so impecunious, that road making for some time will be chiefly confined to the growing cities and towns, the country districts contenting themselves with sand, occasionally alleviated by sawdust or pine straw. Still the agricultural possibilities of the State are very great and it will eventually support a large and well-to-do population. When the time comes for the improvement of our highways there will be no lack of materials at reasonable cost.

